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University of Kentucky

STEER FEEDING

**Substituting a Legume Hay for Corn Silage Toward the
End of the Feeding Period.**

BULLETIN NO. 264.



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BULLETIN NO. 264.

Steer Feeding

Substituting a Legume Hay for Corn Silage Toward the End of the Feeding Period.

By E. S. Good and L. J. Horlacher.

Every year numerous inquiries from cattle feeders are received by the Department of Animal Husbandry stating that their silage is about to give out and asking how to handle their steers. The common belief is that the only thing that can be done is to sell the steers, no matter what may be their degree of finish. This means that the steers must sell for less than they would bring after being fed to the end of the fattening period. In addition the feeder does not receive the margin he would receive were the cattle sold fat. Every steer feeder realizes that a radical change of feed in the middle of a feeding period must necessarily give the steers a serious set-back, but all do not realize that it is possible to make a change in the feed and have the steers continue to put on profitable gains. It was to demonstrate that steers need not be sacrificed before they are fat that this experiment was started. The experiment was planned to obtain data on the comparative gains and profits made by steers that were fed silage thruout the entire fattening period and steers that had legume hay substituted for silage toward the end of the feeding period.

First Experiment

December 28, 1921, to April 19, 1922, inclusive (113 days).

Twenty two-year-old feeder steers were used in this experiment. For ten days before the beginning of the experiment the steers were given a preliminary feed of cottonseed meal, corn

silage, wheat straw and mixed hay. At the close of this preliminary feeding period each steer was eating 1.2 pounds of cottonseed meal and 46 pounds of silage daily.

The steers were divided into two lots of ten each, as evenly as possible with respect to weight, quality, condition and thriftiness. The experiment was begun December 28, 1921.

Lot 5 was fed corn, cottonseed meal, straw and corn silage for 76 days. On the 77th day the substitution of clover hay for silage was begun. This substitution was accomplished by reducing gradually the amount of corn silage fed and at the same time feeding what clover hay the steers would clean up. The corn silage was reduced 10 pounds at each feeding, morning and night. The following figures were taken from the feed sheet for lot 5:

Date	Corn Silage	Clover Hay
Morning feed, March 15.....	180 lbs.....	00
Evening feed, March 15.....	170 lbs.....	102 lbs.
Morning feed, March 16.....	160 lbs.....	00
Evening feed, March 16.....	150 lbs.....	106 lbs.

At the end of 10 days the silage had been eliminated and the steers were on a full feed of clover hay. For the last 27 days the feed consisted of corn, cottonseed meal and clover hay. The steers would not eat straw when clover hay was fed.

Lot 6 was fed corn, cottonseed meal, silage and straw continuously for 113 days.

FEED LOTS

The two lots of 10 steers occupied similar quarters, consisting of a lot 35x70 feet, which was under roof. The water tank was under this cover. Fresh water was available at all times. The steers were kept well bedded.

WEIGHTS

Each steer was weighed on three consecutive days at the beginning and at the end of the experiment. The averages of the three weights at the beginning and the three weights at the end of the feeding period were taken as the initial and final weights,

respectively. Individual weights were taken at 5:30 a. m., before feeding and after water had been shut off for twelve hours.

The identity of each steer was known by a numbered brass tag on a strap fastened around the neck.

METHOD OF FEEDING

These steers were fed according to appetite. On December 28 each steer received 1.6 pounds of cottonseed meal. This was gradually increased until March 17, when each steer received 3 pounds a day. No further change was made. As long as silage was being fed, the steers were given all they would eat. On December 28 this amount was 46 pounds per head, and on March 13, 48 pounds per head. On March 14 the substitution of clover hay for silage in lot 5 was begun. This gradual substitution required 10 days. By the end of the experiment the steers in Lot 6 were eating only 15 pounds of silage per head daily.

Broken ear corn was fed at the beginning of the experiment at the rate of 2 pounds a head daily. This was gradually increased to 11 pounds. As it was impossible to buy more ear corn, shelled corn was substituted for it with the evening feed of February 25. This was increased gradually until on April 2 the steers in each lot were eating 21 pounds each daily.

The silage was placed in the feed troughs, the corn and cottonseed meal poured over it and all thoroly mixed. Straw and hay were fed in racks at the sides of the barn. Salt was kept before the steers at all times. Feeding was begun at 6:30 a. m. and 4:30 p. m.

DESCRIPTION OF THE CATTLE

The twenty two-year-old steers were bred in middle Tennessee. They were medium to choice feeders, thin in condition, and fairly representative of the kind commonly fed in Kentucky. Fourteen of the steers had white faces, while the other six showed evidence of Shorthorn blood.

METHOD OF VALUING THE CATTLE

The price paid for the steers was taken as the initial value. The final value was the selling price in Cincinnati less the costs of shipping, selling and shrinkage.

QUALITY OF THE FEEDS

The corn was sound and of good quality. The cottonseed meal was bought on the basis of 41 per cent of protein. The corn silage was excellent until near the close of the experiment, when it contained some mold. The straw was bright and of good quality. The clover hay was of only medium quality.

TABLE I.
Analyses of the Feeds*

	Corn Silage Per Ct.	C. S. M. Per Ct.	Whole Corn Per Ct.	Shelled Corn Per Ct.	Clover Hay Per Ct.
Protein	3.68	41.13	8.88	9.06	7.90
Fat	1.11	6.73	3.74	3.98	1.44
Fiber	6.67	8.75	1.90	2.20	31.60
Water	66.05	9.92	13.43	12.40	16.92
Ash	1.68	6.14	1.28	1.38	4.93
Nitrogen-free extract	20.81	27.33	70.77	70.98	37.21

*The analyses were made by Howell D. Spears of the Feed Control Department.

PRICES OF FEEDS

The prices of the feeds used were based on the actual farm values at the time the experiment was in progress. Silage was worth \$4.50 a ton, clover hay \$20.00 a ton, cottonseed meal \$40.00 a ton, straw \$9.00 a ton, broken ear corn 62 cents a bushel, and shelled corn 65 cents a bushel.

PIGS

Four pigs were placed behind the steers January 3. Four more were added February 1. They received no additional feed.

The same general plan was followed in the second and third experiments.

RESULTS OF THE FIRST EXPERIMENT

The steers were fed from December 28, 1921, to April 19, 1922, inclusive (113 days). Table II shows the average daily feed consumption.

TABLE II.

Average Amount of Feed Consumed Daily Per Head by Fattening Steers. December 28, 1921, to April 19, 1922, Inclusive (113 Days).

	Lot 5 Corn Cottonseed Meal Corn Silage (86 days*) Clover Hay (37 days*) Straw	Lot 6 Corn Cottonseed Meal Corn Silage Straw
Dec. 28-Jan. 24 (28 days)		
Broken ear corn	4.79 lbs.	4.79 lbs.
Cottonseed meal	2.26 lbs.	2.26 lbs.
Corn silage	43.07 lbs.	43.07 lbs.
Straw .....	.16 lbs.	.16 lbs.
Jan. 25-Feb. 25 (31½ days)		
Broken ear corn	9.93 lbs.	9.93 lbs.
Cottonseed meal	2.75 lbs.	2.75 lbs.
Corn silage	42.32 lbs.	42.32 lbs.
Straw .....	.....	.....
Feb. 25-Mar. 13 (16½ days)		
Shelled corn	10.00 lbs.	10.00 lbs.
Cottonseed meal	2.80 lbs.	2.80 lbs.
Corn silage	46.48 lbs.	46.48 lbs.
Straw .....	.41 lbs.	.42 lbs.
Mar. 14-Mar. 23 (10 days)		
Shelled corn	13.98 lbs.	13.98 lbs.
Cottonseed meal	2.96 lbs.	2.96 lbs.
Corn silage	20.20 lbs.	40.55 lbs.
Straw .....	.....	1.79 lbs.
Clover hay	9.98 lbs.	.....

TABLE II—Continued.

	Lot 5 Corn Cottonseed Meal Corn Silage (86 days*) Clover Hay (37 days*) Straw	Lot 6 Corn Cottonseed Meal Corn Silage Straw
Mar. 24–Apr. 19 (27 days)		
Shelled corn	20.30 lbs.	19.53 lbs.
Cottonseed meal	3.00 lbs.	3.00 lbs.
Corn silage .....	.....	18.65 lbs.
Clover hay	11.87 lbs.	.....
Straw .....	.....	1.61 lbs.
Average for entire period (113 days)		
Corn (shelled corn basis)	10.71 lbs.	10.53 lbs.
Cottonseed meal	2.71 lbs.	2.71 lbs.
Corn silage	40.79 lbs. (86 days)	37.30 lbs.
Clover hay	11.36 lbs. (37 days)	.....
Straw .....	.10 lbs.	.64 lbs.

*Ten days were required for the substitution of clover hay for corn silage. See page 4.

The steers had become accustomed to silage and were on a full feed (46 lbs. per head daily) at the beginning of the experiment. As the corn was increased the silage consumed varied slightly, but remained well above 40 pounds until March 14, on which date the substitution of clover hay for silage in Lot 5 was begun. From that date on the corn was increased more rapidly and the silage consumed by Lot 6 dropt appreciably. During the last 16 days of the experiment the steers in Lot 6 consumed only 15 pounds of silage per head daily.

During the first 76 days the steers were fed with the object of making them eat as much silage as they would and at the same

time consume a medium amount of corn. On March 14 the ration was 2.8 pounds cottonseed meal, 48 pounds silage, and 10 pounds shelled corn per head daily. In the last 37 days this plan was reversed so that they were given all the corn they would eat with a medium amount of silage or hay.

On April 2 the steers in each lot were eating 21 pounds of corn per head daily. On April 6 the steers in Lot 6 failed to consume all their corn so that it was necessary to reduce their corn from 21 pounds to 16 pounds to get them back on feed. By April 12 each steer was again eating 21 pounds a day, but on April 15 this had to be reduced to 20 pounds, where it remained until the end of the experiment. The same change was made with Lot 5 on April 15.

After the steers had become accustomed to cottonseed meal it was gradually increased so that it was fed approximately at the rate of 2.5 pounds per 1,000 pounds live weight.

The steers ate very little straw, tho at times they would pick a little out of their fresh bedding.

The amount of feed consumed for each hundred pounds of gain is shown in Table III.

TABLE III.

Amounts of Feed Consumed for Each Hundred Pounds of Gain, December 28, 1921, to April 19, 1922, Inclusive (113 days).

	Lot 5 Corn Cottonseed Meal Corn Silage Clover Hay Straw	Lot 6 Corn Cottonseed Meal Corn Silage Straw
Feed per cwt. gain		
Corn (shelled corn basis)	416.52 lbs.	387.04 lbs.
Cottonseed meal	105.26 lbs.	99.54 lbs.
Corn silage	1,207.15 lbs.	1,371.62 lbs.
Clover hay	144.63 lbs.	.....
Straw	3.88 lbs.	23.69 lbs.

Lot 6 gained more than Lot 5. Lot 6 ate less corn than Lot 5, the same amount of cottonseed meal, more silage and more

straw. Consequently less corn and less cottonseed meal were required to produce 100 pounds of gain in Lot 6 than in Lot 5, while more silage and more straw were required. The cost per cwt. gain is given in Table V.

The average daily gains made by each lot are shown in Table IV.

TABLE IV
Daily Gain or Loss Per Steer, December 28, 1921, to April 19, 1922,
Inclusive (113 days).

	Lot 5 Corn Cottonseed Meal Corn Silage Clover Hay Straw	Lot 6 Corn Cottonseed Meal Corn Silage Straw
Dec. 28-Jan 24 (28 days).....	2.60 lbs.	3.30 lbs.
Jan. 25-Feb. 21 (28 days).....	3.05 lbs.	1.84 lbs.
Feb. 22-Mar. 13 (20 days).....	3.20 lbs.	3.62 lbs.
Mar. 14-Mar. 23 (10 days).....	-2.45 lbs.	1.00 lbs.
Mar. 24-Apr. 4 (12 days).....	3.91 lbs.	3.62 lbs.
Apr. 5-Apr. 19 (15 days).....	3.05 lbs.	2.49 lbs.
Total gain per steer	290.60 lbs.	307.30 lbs.
Average daily gain entire period	2.57 lbs.	2.72 lbs.

The gains made by these steers were satisfactory. Lot 6 gained more than did Lot 5. From December 28 to March 13 Lot 5 gained slightly more than did Lot 6. The smallest gains were made by both lots during the ten days, March 14-23. This was the period during which the clover hay was being substituted for corn silage in Lot 5. During the ten days the average loss of each steer in Lot 5 was 24.5 pounds. At the same time the amount of silage fed to Lot 6 was materially reduced so that the average total gain of each steer in this lot was only 10 pounds. As was to be expected, some of this shrink was regained immediately so that the following period of twelve days showed a marked increase in the gains of both lots.

A summary of the entire experiment is given in Table V. Prices of feeds are given at the bottom of this table. No charge was made for labor nor for straw used for bedding; neither was any credit given for any manure produced by the steers, it being considered that this by-product would pay for the labor of feeding and the straw used for bedding.

TABLE V.

Summary of First Experiment in Substituting a Legume Hay for Corn Silage Toward the End of the Feeding Period.
December 28, 1921–April 19, 1922, Inclusive (113 days).

	Lot 5 Corn Cottonseed Meal Corn Silage (86 days*) Clover Hay (37 days*) Straw	Lot 6 Corn Cottonseed Meal Corn Silage Straw
Number of steers	10	10
Initial weight	9,207 lbs.	9,190 lbs.
Initial value per cwt	\$6.25	\$6.25
Final weight	12,113 lbs.	12,263 lbs.
Total gain	2,906 lbs.	3,073 lbs.
Average daily gain	2.57 lbs.	2.72 lbs.
Total Feed Consumed:		
Broken ear corn (59½ days).....	4,470 lbs.	4,470 lbs.
Shelled corn (53½ days)	8,528 lbs.	8,318 lbs.
Cottonseed meal	3,059 lbs.	3,059 lbs.
Silage	35,080 lbs.	42,150 lbs.
Clover hay	4,203 lbs.	.....
Straw	113 lbs.	728 lbs.
Average Daily Feed Per Steer:		
Corn (shelled corn basis)	10.71 lbs.	10.52 lbs.
Cottonseed meal	2.71 lbs.	2.71 lbs.
Silage	40.79 lbs.	37.30 lbs.
	(86 days)	
Clover hay	11.36 lbs.	.....
	(37 days)	
Straw .....	.10 lbs.	.64 lbs.

	Lot 5 Corn Cottonseed Meal Corn Silage (86 days*) Clover Hay (37 days*) Straw	Lot 6 Corn Cottonseed Meal Corn Silage Straw
Cost of feed	\$321.23	\$295.44
Cost of cattle	575.44	574.38
Total cost	896.67	869.82
Cost per cwt. gain	11.05	9.61
Necessary selling price per cwt.....	7.40	7.09
Value of steers per cwt. in lots.....	7.94	7.88
Total value of steers	961.77	966.32
Return per steer over initial cost and feed cost	6.51	9.65
Pork produced	292 lbs.	292 lbs.
Value of pork @ \$9.50	\$27.74	\$27.74
Return per steer, pork included.....	9.28	12.42

Cost of feeds: Silage \$4.50 a ton; broken ear corn 62c a bushel; shelled corn 65c a bushel; clover hay \$20 a ton; cottonseed meal \$40 a ton; straw \$9 a ton.

Gain or loss per steer during the ten days required to change the steers in Lot 5 from silage to hay:

Lot 5	Lot 6
24.5 lbs. (loss)	10 lbs. (gain)

The Lexington value of Lot 5 was \$7.94 per cwt., making a net return of \$5.63 per steer. The value of Lot 6 was \$7.88 per cwt., making a net return of \$8.60 per steer, or \$2.97 more per head than in Lot 5.

The pigs received no feed other than that which they picked up from the droppings. As the 8 pigs were given the freedom of both lots, the amount of pork produced was credited equally. The pork was valued at \$9.50 per cwt., thus increasing

*Ten days were required for the substitution of clover hay for corn silage. See page 4.

the net return per steer \$2.77. Thus, the pork increased the net return per steer in Lot 5 49.5 per cent and in Lot 6 32.2 per cent.

SELLING DATA

The experiment closed on Wednesday, April 19. The steers were not sold until the following Monday. In preparing the steers for shipping Lot 6 was given no silage after Friday morning. The corn ration of each lot was cut in half Friday night and Saturday morning both lots were given all the clover hay they would eat. At two o'clock on Saturday afternoon they were weighed, driven two miles to the loading place, weighed again and loaded. They arrived in Cincinnati Sunday morning and were sold Monday morning. Table VI gives the shrinkage of the steers.

TABLE VI.
Weights and Shrinkage of Steers.

	Lot 5		Lot 6	
Weight at close of experiment.....	12,113	lbs.	12,263	lbs.
Weight at Station Farm, April 22.....	12,160	lbs.	12,270	lbs.
Weight at loading point, April 22.....	12,130	lbs.	12,240	lbs.
Weight in Cincinnati when sold Apr. 24	12,120	lbs.	12,170	lbs.
Shrinkage (from close of experiment)...	(gain) 7	lbs.	93	lbs.
Shrinkage (from weights at loading point)	10	lbs.	70	lbs.
Dressing percentage	57.09	lbs.	57.41	lbs.

The smaller shrink was in Lot 5, receiving clover hay. The shrink in Lot 6, however, was light. The difference in dressing percentage was slight, but Lot 6, which shrank more in shipping, dressed the higher percentage. The steers took a good fill in Cincinnati.

Second Experiment

November 3, 1922, to March 5, 1923 (123 days).

Twenty head of two-year-old feeder steers were purchased for this experiment. They were bred in middle Tennessee. The

majority of these steers were good to choice white-faced feeders. During the eighteen mile drive to the Experiment Station farm they shrank 52 pounds a head.

The experiment was not started until the cattle had become accustomed to their feed and had regained this shrink.

TABLE VII.
Analyses of Feeds*

	Corn Silage Per Cent	C. S. M. Per Cent	Shelled Corn Per Cent	Clover Hay Per Cent
Protein	3.27	41.62	9.50	9.50
Fat	1.37	7.45	3.97	2.83
Fiber	8.12	8.83	2.12	26.80
Water	59.86	8.67	13.57	11.36
Ash	1.93	6.46	1.27	5.05
Nitrogen-free extract	25.45	26.97	69.57	44.46

*The analyses were made by Howell D. Spears of the Feed Control Department.

These figures show that the silage, cottonseed meal and clover hay contained less moisture than the feeds used in the preceding year, while the corn contained more water.

TABLE VIII.

Average Amount of Feed Consumed Daily Per Head by Fattening Steers. November 3, 1922, to March 5, 1923, Inclusive (123 days).

	Lot 5 Shelled Corn Cottonseed Meal Corn Silage (70 days*) Clover Hay (63 days*) Straw	Lot 6 Shelled Corn Cottonseed Meal Corn Silage Straw
November 3-December 2 (30 days)		
Shelled corn	7.04 lbs.	7.04 lbs.
Cottonseed meal	2.28 lbs.	2.28 lbs.
Corn silage	49.40 lbs.	49.83 lbs.
Straw	1.90 lbs.	1.84 lbs.

TABLE VIII—Continued.

	Lot 5 Shelled Corn Cottonseed Meal Corn Silage (70 days*) Clover Hay (63 days*) Straw	Lot 6 Shelled Corn Cottonseed Meal Corn Silage Straw
December 3–January 1 (30 days)		
Shelled corn	12.54 lbs.	12.54 lbs.
Cottonseed meal	2.75 lbs.	2.75 lbs.
Corn silage	38.96 lbs.	39.36 lbs.
Straw .....	.31 lbs.	.30 lbs.
January 2–January 11 (10 days)		
Shelled corn	15.25 lbs.	15.25 lbs.
Cottonseed meal	2.80 lbs.	2.80 lbs.
Corn silage	14.40 lbs.	32.40 lbs.
Clover hay	10.14 lbs.	
Straw .....		.85 lbs.
January 12–February 10 (30 days)		
Shelled corn	17.98 lbs.	17.83 lbs.
Cottonseed meal	2.80 lbs.	2.85 lbs.
Corn silage		20.68 lbs.
Clover hay	12.52 lbs.	
Straw .....		.27 lbs.
February 11–March 5 (23 days)		
Shelled corn	18.26 lbs.	17.70 lbs.
Cottonseed meal	2.80 lbs.	3.16 lbs.
Corn silage		19.15 lbs.
Clover hay	11.83 lbs.	
Straw .....		.76 lbs.
Average for entire period (123 days)		
Shelled corn	13.91 lbs.	13.77 lbs.
Cottonseed meal	2.66 lbs.	2.74 lbs.
Corn silage	39.92 lbs.	33.01 lbs.
	(70 days)	
Clover hay	11.90 lbs.	
	(63 days)	
Straw .....	.54 lbs.	.80 lbs.

*Ten days were required for the substitution of clover hay for corn silage. See page 4.

As in the preceding year the steers had become accustomed to silage and were eating 45 pounds each daily at the beginning of the experiment. On November 4 this was increased to 50 pounds. They had become accustomed to cottonseed meal also and were eating 1.4 pounds per head. The first day's ration of corn was 3 pounds per steer. As the corn and cottonseed meal were increased the amount of silage eaten fluctuated slightly but did not begin to decrease materially until December 9, on which date each steer was eating 11.4 pounds of corn and 2.8 pounds of cottonseed meal. From January 20 to the end of the experiment the steers in Lot 6 ate approximately 20 pounds of silage per head daily. From February 3 to the end of the experiment the steers in Lot 6 were given slightly more cottonseed meal than were the steers in Lot 5. This was not done in the first experiment.

After the substitution of clover hay in Lot 5 it was planned to keep both lots consuming the same amounts of shelled corn, but much difficulty was experienced in keeping Lot 6 up to the standard set by Lot 5, so that from time to time the corn fed to Lot 6 had to be reduced in amount.

On February 15 an attempt was made to increase the corn to 20 pounds per head daily, but the steers in neither lot would consume this amount, so that the practical maximum of corn fed at any time was 18 pounds.

After the steers had become accustomed to cottonseed meal it was increased gradually so that it was fed at the rate of slightly over 2.5 pounds per 1,000 pounds of live weight.

The steers ate very little straw, tho at times they would pick some out of their fresh bedding. No straw was fed to Lot 5 while clover hay was being fed.

The amount of feed consumed per hundred pounds of gain is shown in Table IX.

TABLE IX.

Amounts of Feed Consumed Per Hundred Pounds Gain, November 3, 1922, to March 5, 1923, Inclusive (123 days).

	Lot 5 Shelled Corn Cottonseed Meal Corn Silage Clover Hay Straw	Lot 6 Shelled Corn Cottonseed Meal Corn Silage Straw
Feed per cwt. gain—		
Shelled corn	593.17 lbs.	633.03 lbs.
Cottonseed meal	113.59 lbs.	126.12 lbs.
Corn silage	968.73 lbs.	1,515.00 lbs.
Clover hay	251.05 lbs.	
Straw	22.27 lbs.	36.88 lbs.

Lot 5 gained more than Lot 6. Lot 5 ate more corn than did Lot 6, but required less corn for each hundred pounds of gain. Lot 5 ate less cottonseed meal, silage and straw than did Lot 6, and consequently required much less of each of these feeds per cwt. gain. In this experiment Lot 5 required 39.86 lbs. less corn and 12.53 lbs. less cottonseed meal per cwt. gain than did Lot 6, while in the preceding experiment Lot 6 required 29.48 lbs. less corn and 4.72 lbs. less cottonseed meal per cwt. gain than did Lot 5.

Lot 5 in this experiment required 238.42 lbs. less silage per cwt. gain than did lot 5 the year before, but this was offset by 107.42 lbs. more clover hay and 18.39 lbs more straw. This is partially due to the fact that in the second experiment silage was fed only 70 days and clover hay was fed 63 days, while in the first experiment silage was fed 86 days and hay only 37 days. The cost per cwt. gain is given in Table XI. The average daily gains made by each lot are shown in Table X.

TABLE X.

Daily Gains Per Steer, November 3, 1922, to March 5, 1923, Inclusive
(123 days).

	Lot 5 Shelled Corn Cottonseed Meal Corn Silage Clover Hay Straw	Lot 6 Shelled Corn Cottonseed Meal Corn Silage Straw
November 3-December 14 (42 days)....	2.54 lbs.	2.30 lbs.
December 15-January 1 (18 days).....	3.05 lbs.	2.88 lbs.
January 2-January 11 (10 days) .....	.70 lbs.	3.30 lbs.
January 12-February 8 (28 days).....	.98 lbs.	.96 lbs.
February 9-March 5 (25 days)	3.68 lbs.	2.37 lbs.
Total gain per steer	288.5 lbs.	267.6 lbs.
Average daily gain for entire period....	2.35 lbs.	2.18 lbs.

While these steers made good gains, they were smaller than the gains made in the preceding experiment. The two lots reversed in gains. In this experiment the advantage is 20.9 lbs. per steer in favor of Lot 5, as compared with 16.7 lbs. per steer in favor of Lot 6 the year before. One of the biggest factors in this change was the fact that during the ten days required to change from silage to clover hay each steer in Lot 5 gained 7 lbs., while in the first experiment each steer lost 24.5 lbs. That the steers in Lot 5 were slightly better feeders than those in Lot 6 was evidenced by the fact that during the 60 days preceding the substitution of hay for silage these steers gained more.

A summary of this second experiment is given in Table XI.

TABLE XI.

Summary of Second Experiment in Substituting a Legume Hay for Corn Silage Toward the End of the Feeding Period.
November 3, 1922-March 5, 1923, Inclusive (123 days).

	Lot 5 Shelled Corn Cottonseed Meal Corn Silage (70 days*) Clover Hay (63 days*) Straw	Lot 6 Shelled Corn Cottonseed Meal Corn Silage Straw
Number of steers	10	10
Initial weight	9,532 lbs.	9,517 lbs.
Initial value per cwt.	\$7.25	\$7.25
Final weight	12,417 lbs.	12,193 lbs.
Total gain	2,885 lbs.	2,676 lbs.
Average daily gain	2.35 lbs.	2.18 lbs.
Total feed consumed:		
Shelled corn	17,113 lbs.	16,940 lbs.
Cottonseed meal	3,277 lbs.	3,375 lbs.
Silage	27,948 lbs.	40,612 lbs.
Clover hay	7,494 lbs.	-----
Straw	665 lbs.	987 lbs.
Average daily feed per steer:		
Shelled corn	13.91 lbs.	13.77 lbs.
Cottonseed meal	2.66 lbs.	2.74 lbs.
Silage	39.92 lbs.	23.01 lbs.
	(70 days)	
Clover hay	11.90 lbs.	-----
	(63 days)	
Straw .....	.54 lbs.	.80 lbs.
Cost of feed	\$496.13	\$457.18
Cost of cattle	691.43	689.98
Total cost	1,187.56	1,147.16
Cost per cwt. gain	17.19	17.08
Necessary selling price per cwt.....	9.56	9.41
Value of steers per cwt in lots.....	8.90	8.80
Total value of steers	1,105.11	1,072.98
Loss per steer	8.24	7.41
Pork produced	285 lbs.	285 lbs.
Value of pork at \$8.00	\$22.80	\$22.80
Loss per steer, pork included	5.96	5.13

*Ten days were required for the substitution of clover hay for corn silage. See page 4.

Cost of feeds: Silage, \$5.50 a ton; shelled corn 85c a bushel; clover hay \$20 a ton; cottonseed meal \$50 a ton; straw \$8 a ton

Gain or loss per steer during the ten days required to change the steers in Lot 5 from silage to hay:

Lot 5	Lot 6
7.0 lbs. (gain)	33 lbs. (gain)

As in the first experiment the cost of feed for Lot 5 was greater than for Lot 6. The difference in the necessary selling price was only 15 cents per cwt. compared with 30 cents in the first year. The steers in Lot 5 were valued at 10 cents per cwt. more than those in Lot 6. They were slightly fatter. The steers in Lot 5 lost 83 cents more a head than the steers in Lot 6. This is much less difference than in the first experiment, tho the advantage there was in favor of Lot 6.

The hogs received no feed other than that which they picked up in the droppings. During the early part of the experiment three hogs were used. These were later replaced by nine others. All hogs were given the freedom of both lots. With the pork valued at \$8.00 per cwt. the loss for each steer was lessened \$2.28.

SELLING DATA

The experiment closed on March 5. The steers were not sold until March 19. In preparing the steers for shipping the corn, cottonseed meal and silage were reduced one-half with the evening feed of March 16 and the morning feed of March 17. At the evening feed of March 16 one bale of timothy hay was fed each lot. At 2 p. m. on March 17 the steers were weighed driven to the stock yards in Lexington, and loaded out for Cincinnati. They arrived in Cincinnati Sunday morning and were sold Monday morning. Table XII shows the weights and shrinkage.

TABLE XII.
Weights and Shrinkage of Steers.

	Lot 5	Lot 6
Weight at Station Farm, March 17.....	12,860 lbs.	12,410 lbs.
Weight when sold in Cincinnati, Mar. 17	12,480 lbs.	12,150 lbs.
Shrinkage	380 lbs.	260 lbs.
Dressing percentage	60.48%	57.24%

The shrinkage was much greater than in the preceding year. The smaller shrink was in Lot 6, just opposite from the preceding year. There was a difference of 3.24 per cent in dressing in favor of Lot 5.

Third Experiment

November 15, 1923, to April 17, 1924 (155 days).

As in the two preceding years twenty head of middle Tennessee two-year-old steers were used in the experiment. They were a mixed bunch of steers, slightly heavier than the steers used in the preceding experiments, and of poorer quality. They graded as medium feeders.

The analyses of the feeds used are shown in Table XIII.

TABLE XIII.
Analyses of Feeds*

	Corn Silage Per Cent	C. S. M. Per Cent	Whole Corn Per Cent	Alfalfa Hay Per Cent
Protein	2.62	39.50	7.63	14.06
Fat	1.62	6.40	4.51	1.60
Fiber	6.58	12.80	2.25	30.58
Water	71.08	6.85	13.80	8.25
Ash	1.64	5.48	1.25	6.25
Nitrogen-free extract	16.46	28.97	70.56	39.26

*Analyses by Howell D. Spears of the Feed Control Department.

During the year cattle feeders constantly made statements to the effect that their silage was not as good as in previous years. A wet season in 1923 produced an enormous growth of the stalks and a high yield of silage. The analysis of the silage shows that it contained much more water than the silage of the two preceding years. The alfalfa hay contained less moisture and more protein than the clover hay used in the first two experiments.

Table XIV shows the average daily feed consumption.

TABLE XIV.

Average Amount of Feed Consumed Daily Per Head by Fattening Steers, November 15, 1923, to April 17, 1924, Inclusive (155 days).

	Lot 5 Broken Ear Corn Cottonseed Meal Corn Silage* Alfalfa Hay* Straw	Lot 6 Broken Ear Corn Cottonseed Meal Corn Silage Straw
November 15–December 12 (28 days)		
Cottonseed meal	2.72 lbs.	2.72 lbs.
Corn silage	55.71 lbs.	55.71 lbs.
Straw	4.30 lbs.	4.18 lbs.
December 13–January 9 (28 days)		
Broken ear corn	8.17 lbs.	8.17 lbs.
Cottonseed meal	3.20 lbs.	3.20 lbs.
Corn silage	45.02 lbs.	45.02 lbs.
Straw	2.25 lbs.	2.24 lbs.
January 10–February 26 (47½ days)		
Broken ear corn	14.59 lbs.	14.67 lbs.
Cottonseed meal	3.20 lbs.	3.20 lbs.
Corn silage	29.21 lbs.	29.54 lbs.
Straw	1.54 lbs.	1.06 lbs.

TABLE XIV—Continued.

	Lot 5 Broken Ear Corn Cottonseed Meal Corn Silage* Alfalfa Hay* Straw	Lot 6 Broken Ear Corn Cottonseed Meal Corn Silage Straw
February 26–March 4 (7 days)		
Broken ear corn	16.00 lbs.	16.00 lbs.
Cottonseed meal	2.23 lbs.	3.20 lbs.
Corn silage	13.57 lbs.	25.00 lbs.
Alfalfa hay	6.71 lbs.	.....
Straw .....	.....	.....
March 4–April 17 (44½ days)		
Broken ear corn	22.14 lbs.	20.92 lbs.
Cottonseed meal	1.66 lbs.	3.20 lbs.
Corn silage .....	.....	20.21 lbs.
Alfalfa hay	9.47 lbs.	.....
Straw .....	.21 lbs.	.57 lbs.

*Seven days were required for the substitution of alfalfa hay for corn silage. See page 4.

In order that the steers might regain most of the shrink and become accustomed to the feed which they were to receive they were given a preliminary feed for eight days. At the beginning of the experiment each steer was consuming 50 pounds of silage and 1.6 pounds of cottonseed meal daily. By December 7, the amount of silage had been increased to 60 pounds, where it remained until corn was added to the ration. No corn was fed for the first four weeks.

TABLE XV.
Amounts of Feed Consumed Per Hundred Pounds of Gain.

	Lot 5	Lot 6
Feed per cwt. gain—		
Broken ear corn	693.95 lbs.	720.15 lbs.

TABLE XV—Continued.

	Lot 5	Lot 6
Cottonseed meal	139.93 lbs.	175.85 lbs.
Corn silage	1,478.66 lbs.	1,937.60 lbs.
Alfalfa hay	161.00 lbs.	.....
Straw	94.94 lbs.	97.14 lbs.

**TABLE XVI.
Daily Gains Per Steer.**

	Lot 5	Lot 6
November 15–December 12 (28 days)....	0.68 lbs.	0.19 lbs.
December 13–February 26 (76 days).....	2.43 lbs.	2.63 lbs.
February 27–March 4 (7 days).....	0.14 lbs.	0.00 lbs.
March 5–April 17 (44 days)	1.96 lbs.	1.55 lbs.
Average daily gain for entire period..	1.88 lbs.	1.77 lbs.

It has been stated before that no corn was fed during the first four weeks and that the silage contained a large percentage of water. These two facts account for the small gains made in the first four weeks. The gains made were smaller than those made in the two preceding years. As in the second experiment the larger gains were made by Lot 5. Table XVI shows that the excess gain occurred after alfalfa hay was added to the ration. Reference to Tables IV and X shows that in each of the two preceding years Lot 5 gained more than Lot 6 after the clover hay was added.

When alfalfa hay was added to the ration of Lot 5 the amount of cottonseed meal fed was reduced so that the amount of protein in the cottonseed meal and alfalfa hay combined equaled that in the cottonseed meal fed to Lot 6.

A summary of the third experiment is given in Table XVII. Prices of feeds are given at the bottom of the table.

TABLE XVII.

Summary of Third Experiment in Substituting a Legume Hay for
Corn Silage Toward the End of the Feeding Period.
November 15, 1923–April 17, 1924, Inclusive (155 days).

	Lot 5 Broken Ear Corn (127 days) Cottonseed Meal Corn Silage (110 days*) Alfalfa Hay (51 days*) Straw	Lot 6 Broken Ear Corn (127 days) Cottonseed Meal Corn Silage Straw
Number of steers	10	10
Initial weight	10,170 lbs.	10,176 lbs.
Initial value per cwt.	\$7.00	\$7.00
Final weight	13,080 lbs.	12,910 lbs.
Total gain	2,910 lbs.	2,734 lbs.
Average daily gain	1.88 lbs.	1.77 lbs.
Total feed consumed:		
Broken ear corn	20,194 lbs.	19,689 lbs.
Cottonseed meal	4,072 lbs.	4,808 lbs.
Silage	43,029 lbs.	52,974 lbs.
Alfalfa hay	4,685 lbs.	.....
Straw	2,763 lbs.	2,656 lbs.
Average daily feed per steer:		
Broken ear corn	15.9 lbs. (last 127 days)	15.5 lbs. (last 127 days)
Cottonseed meal	2.62 lbs.	3.1 lbs.
Silage	39.12 lbs. (110 days)	34.18 lbs.
Alfalfa hay	9.18 lbs. (51 days)	.....
Straw	1.78 lbs.	1.71 lbs.
Cost of feed	\$530.06	\$522.34
Cost of cattle	711.90	712.32
Total cost	1,241.96	1,234.66
Cost per cwt. gain	18.21	19.10

TABLE XVII—Continued.

	Lot 5 Broken Ear Corn (127 days) Cottonseed Meal Corn Silage (110 days*) Alfalfa Hay (51 days*) Straw	Lot 6 Broken Ear Corn (127 days) Cottonseed Meal Corn Silage Straw
Necessary selling price per cwt.	9.49	9.56
Value of steers per cwt. in lots.....	9.80	10.00
Total value of steers	1,281.84	1,291.00
Return per steer over initial cost and feed cost	3.99	5.63
Pork produced	268 lbs.	268 lbs.
Value of corn fed to hogs	\$4.25	\$4.25
Value of pork at \$7.50.....	20.10	20.10
Net value of pork	15.85	15.85
Return per steer, pork included.....	5.58	7.22

*Seven days were required for the substitution of alfalfa hay for corn silage. See page 4.

Cost of Feeds: Silage \$5.50 a ton; broken ear corn 85c a bu.; alfalfa hay \$20 a ton; cottonseed meal \$50 a ton; straw \$13 a ton.

Gain or loss per steer during the seven days required to change the steers in Lot 5 from silage to hay:

Lot 5	Lot 6
1 lb. (gain)	0 lbs.

At the close of the experiment the steers were sold at auction. Both lots sold for more than the cost of feed and cattle. The steers in Lot 5 gained more than those in Lot 6, their feed cost more, but the necessary selling price was seven cents a hundred less. They were valued at twenty cents less consequently gave a smaller net return per head. This difference was \$1.64. This agrees with the results of the first two experiments.

The hogs were fed a small amount of corn in addition to what they picked out of the droppings. As the 8 hogs were given

the freedom of both lots the amount of pork produced was credited equally. The pork increased the returns per steer \$1.59. The hogs lacked in thrift and were poor gainers.

SUMMARY AND CONCLUSIONS

The results of these three experiments show that:

1. If the silage gives out before the steers are fat it is not necessary to sell them at that time. A legume hay can be substituted for the silage and the steers will continue to make satisfactory gains.

2. However, steers fed silage thruout the entire feeding period returned slightly more or lost slightly less money than steers fed legume hay during the latter part of the feeding period.

3. In two of the three experiments the steers fed legume hay were slightly fatter and were valued at slightly more per cwt. than those that were not given hay.

4. In two of the three experiments the steers fed legume hay made the greater gains. The increase in gains occurred after hay was substituted for silage.

5. The smaller net return in the lot fed hay was due to the relatively high price of hay.

